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POPULATION CHARACTERISTICS OF HUMPBACK WHALES IN GLACIER BAY AND ADJACENT WATERS: SUMMER 1987

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ABSTRACT

A total of 59 individual whales, including 4 calves (6.8%), were identified in the combined areas of Glacier Bay and Icy Strait. Of this total, 11 whales were found only in Glacier Bay, 28 only in Icy Strait, and 22 were common to both areas. Ten whales, including one calf, were resident in Glacier Bay for periods of least three weeks each. Whales were found in the mouth of Muir Inlet during June and in Whidbey Passage and the lower bay during July. The largest number of whales were found in the bay during early July and only a few animals remained through August and September. The primary foraging strategy of humpback whales in Glacier Bay was solitary near-shore browsing and their primary prey appeared to be schooling fish, probably capelin (Mallotus villosus) and sand lance (Ammodytes hexapterus). Near Point Adolphus in Icy Strait, twenty whales, including one calf, were resident for periods of at least three weeks. The largest number of whales were found near the point in late July and early August. As in some previous years, six adults formed a "core group" which foraged together cooperatively. The primary prey of whales at Point Adolphus appeared to be Pacific herring (Clupea harengus). A general increase in the number of whales in the Glacier Bay - Icy Strait area during the last few years is the result of the continued return of past residents and their offspring, as well as the establishment of residency by previously transient individuals.

INTRODUCTION

In the years prior to 1978, as many as 24 whales entered Glacier Bay and remained there to feed for a substantial part of the summer. In 1978, however, most of the whales that entered the bay abruptly departed soon after their entry. Two hypotheses were advanced to explain this sudden departure. The first asserted that vessel traffic disturbed the behavior of whales and that the exponential increase of vessel traffic in Glacier Bay during the years prior to and including 1978 forced the whales to "abandon" the bay. The second hypothesis proposed that the whales' departure was the result of a natural decline in the availability of their prey within Glacier Bay.

In 1981 the National Park Service, with the consultation of the National Marine Mammal Laboratory, initiated a multi-disciplinary study of humpback whales to help determine the reasons for their sudden departure in 1978. Studies of the acoustic environment and behavior of humpback whales demonstrated predictable short-term changes in their movement and respiration as a function of vessel traffic and noise (Baker et al. 1982; Baker et al. 1983; Baker and Herman 1987; Dean et al. 1985; Malme et al. 1982; Miles and Malme 1983). The assessment of humpback whale prey showed considerable seasonal and yearly variation in the abundance and primary species of prey in Glacier Bay, as well as a correlation in prey availability and whale distribution in other areas of Southeast Alaska (Wing and Krieger 1983; Krieger and Wing 1984; Krieger and Wing 1986).

Although these studies have corroborated some aspects of both hypotheses, they have not yet demonstrated conclusively the reasons for the whales' departure from the bay in 1978. Given the absence of data on prey abundance prior to 1978 and the difficulty in experimentally determining the levels of vessel activity that could result in abandonment of a habitat, the exact cause of the 1978 departure may never be entirely resolved. Nonetheless, the studies initiated and funded by the National Park Service have answered many questions concerning the behavior and ecology of humpback whales in Glacier Bay and throughout southeastern Alaska (Baker et al. 1985; Baker et al. 1986). It seems certain that these data will be of long-term value to the management of humpback whales in southeastern Alaska and throughout their migratory range.

Here I summarize the results of the ongoing monitoring of humpback whales in Glacier Bay and Icy Strait during the 1987 summer season. This summary provides an additional yearly contribution to one of the longest time-series of data available for a population of living baleen whales (Vequist and Baker 1987; Perry et al. 1985; Jurasz and Palmer 1981).

METHODS

Vessel surveys

Humpback whales were observed and photographed from a 17-foot Boston Whaler powered by a 50-hp Johnson outboard motor. Surveys for whales in Glacier Bay usually included the entire lower and mid-bay to Sturgess Island or Geikie Inlet. Several of the surveys reached as far into the East Arm as Point George and as far into the West Arm as Lamplugh Glacier and Tarr Inlet. Surveys for whales in Icy Strait were generally confined to the waters just outside of the bay's mouth and the coastline a few miles east and west of Point Adolphus on Chichagof Island.

Humpback whale surveys in Glacier Bay were conducted on 3 days in May, 12 days during June, 12 days during July, 5 days in August, and 1 day in September, 1987 (see Appendix II for a chronological listing of survey days and whale sightings). Surveys in Icy Strait were conducted during 2 days in May, 5 days in June, 7 days in July, 7 days in August, and 2 days in September. In most cases, the number of surveys on each area was limited to two or three a week to minimize any possible impact that the monitoring program might have on the whales.

29=GB J,J,Aug

19=IS

Photo-Identification

Photographs were taken with a Canon A1 camera equipped with a motor-drive and a 70 to 205 mm zoom or a 300 mm telephoto lens. High speed (ASA 400) film was used to obtain clear photographs of the dorsal fin and the ventral surface of each whale's tail flukes for the purposes of individual identification (Katona et al. 1979; Baker et al. 1986). These individual identification photographs were then compared to available photographs (Perry et al. 1985) to determine the past sighting history of each whale. Individual whales are referred to by an identification number from the University of Hawaii's Kewalo Basin Marine Mammal Laboratory catalog. Individuals previously identified by Jurasz and Palmer (1981a; 1981b) are also cross-referenced to their previously assigned nicknames. Whales not known to have been previously photo-identified are designated by a code referring to the area and sequence of their sighting. For example, AIS-02 was the second previously unidentified animal sighted at Icy Strait this summer. Information on the date, location, and behavioral roles of all sighted whales is stored on a dBase III+ file at Glacier Bay National Park (see Appendix II).

Prey Assessment

Prey abundance in the vicinity of feeding whales was

qualitatively assessed with a Ross Fineline 250-C recording fathometer equipped with a 22 degree beam, 100 kHz transducer. This frequency transducer was chosen in order to allow the discrimination of both fish and planktonic targets in the upper 150 m of water. The sensitivity (set at 7) and the paper speed (set at 2) of the fathometer were standardized to allow for qualitative comparison to previous years and across sampling episodes. Quantitative hydroacoustic assessment of whale prey was conducted during three surveys conducted by Ken Krieger, of the Auke Bay Laboratory, using methods and equipment comparable to those used in previous years (Wing and Krieger 1982; Krieger and Wing 1984). The results of these surveys will be summarized elsewhere.

RESULTS

Abundance

A total of 59 individual humpback whales were identified in the combined areas of Glacier Bay and Icy Strait between May 9 and September 28, 1987 (Appendix I). This is the largest number of whales recorded since systematic surveys were begun in this area during the early 1970s (Vequist and Baker 1987; Perry et al. 1985). Of this total, 11 individuals were sighted only in Glacier Bay, 28 were sighted only in Icy Strait and 22 were sighted in both areas.

Table 1.
The standardized and total abundance (in parentheses) of humpback whales (adults and calves) identified in Glacier Bay and Icy Strait: 1982 to 1987.

	Annual Counts of Whales					
	1982	1983	1984	1985	1986	1987
Glacier Bay	22 (22)	10 (10)	24 (25)	10 (15)	26 (32)	28 (33)
Icy Strait	15 (15)	9 (9)	21 (22)	19 (30)	27 (35)	34 (48)
Combined	33 (33)	17 (17)	39 (39)	27 (41)	42 (51)	49 (59)

Note: Standardized abundance refers to the number of whales sighted during a standardized sampling period of early July to mid-August used in the years 1982 to 1985 (Perry et al. 1985).

Restricting the photo-identification sample to the months of July and August, a period comparable to the shorter sampling period in some earlier years (Perry et al. 1985; Baker 1985a), would result in a count of 28 whales sighted in the bay and 34 whales sighted in Icy Strait (Table 1). Even in this restricted sampling period, the counts are slightly higher than any previously documented.

Birth Rates and Juvenile Survival

Of the 59 whales identified in Glacier Bay - Icy Strait during 1987, 4 were calves (a crude birth rate of 6.8%). This compares to a crude birth rate for this area of 15.7% in 1986, 4.5% in 1985, 17.9% in 1984, 0.0% in 1983, and 18.2% in 1982 (Baker 1986; Baker 1985a; Perry et al. 1985). Although this variation is substantial, a Test of Independence indicated that the magnitude of yearly differences is not significant (Chi-square [5] = 8.26; $p > 0.05$).

Several whales, first identified in the Glacier Bay or Icy Strait as calves (defined as an animals less than one year of age and accompanied by their mother), have developed persistent fidelity to this area. Three returning juveniles (defined as an animals five years old or less) were identified in the area this year. Animal #186, the calf of #530 in 1982, returned for the fourth consecutive year. Animal #352, the calf of #530 in 1984, and animal #353, the calf of #581 in 1984, were sighted for the first time since they were identified as calves. A fourth individual, referred to as #193y (Table 1), returned as a yearling still accompanied by its mother, #193 (referred to as AIS05 cow and calf in Baker, 1986).

The only adult of known age is Garfuncle (#516), first identified in Glacier Bay as a calf in 1974. He has returned to this area in at least nine of the 13 years since his birth.

Seasonal Influx and Distribution

Glacier Bay. Few, if any, whales were present in Glacier Bay during May. No whales were observed in the bay during a three-day survey on May 23 - 25. During early June, four to six whales moved into the bay and concentrated their activity in the mouth of Muir Inlet and the lower West Arm (Figure 1a). In late June and during July whales were found most commonly in Whidbey Passage and throughout the lower bay (Figure 1b). The majority of whales departed the bay in late July and only 3 individual whales were sighted during surveys of the bay in August (Figure 1c). The maximum number of whales sighted in Glacier Bay during a single survey was nine on July 8.

Icy Strait. Whale were concentrated near Point Adolphus throughout the summer; a fact that did not escape the notice of cruise ships, charter boats, and private vessels intent on whale-watching (see Appendix III and IV). About 12 whales, including many of the former "core group" (Perry et al. 1985), were found near the point during late May and early June (Appendix I). By late June and throughout July and August, perhaps 20 whales were found in the area. The largest number of whales sighted near Point Adolphus during a single survey was 17 on July 28.

Local Movement and Residency

Twenty-two whales were identified in both Glacier Bay and Icy Strait and nine of these whales made one or more round-trips (i.e. moved from one area to the other and back). This within-season interchange, and previously documented across-years interchange (Vequist and Baker 1987; Perry et al. 1985), supports the conclusion that most individual whales treat these two areas as a single habitat.

A total of 34 individuals were resident for at least three weeks (e.g. a resighting interval of at least 20 days) in the combined Glacier Bay - Icy Strait areas (see Appendix I for complete sighting records). One individual, Chop Suey (#118), remained in the area from at least May 9 to September 28, a period of almost five months. Seven other individuals remained for at least three months: MD (#157), Garfuncle (#516), Scoper (#577), Gertrude (#587), #530, #351, and #352.

Although the interchange of whales between Glacier Bay and Icy Strait argues against the validity of the "residency" measurement as restricted to one area alone, some measure of the number of residents in each area is important for historical comparison (Vequist and Baker 1987). It was possible to determine, with reasonable certainly, that 10 individuals were resident in Glacier Bay for periods of at least three weeks (Table 2). One whale, AGB01, was sighted only twice but appears to have been in the bay for over 9 weeks. At Point Adolphus, 20 whales were resident for at least three weeks and many of these remained much longer.

Table 2
The interval of residency for whales in Glacier Bay: Summer 1987.

Case	ID	Name	First Day	Last Day	Interval
1.	117	White Eyes	Jun 1	Jun 29	28
2.	118	Chop Suey	Jun 1	Jul 8	37
3.	564	R.U. Taylor	Jun 8	Jul 6	28
4.	351		Jun 11	Jul 8	27
5.	221		Jun 15	Jul 23	38
6.	--	AGB-01	Jun 24	Aug 25	62
7.	262		Jun 26	Jul 16	20
8.	566		Jun 18	Jul 8	20
9.	235	Spot	Jun 29	Jul 25	26
10.	--	Spot's calf	Jun 29	Jun 25	26

Prey Assessment and Foraging Strategies

Glacier Bay. The predominant prey of humpback whales in Glacier Bay appeared to be small schooling fish, particularly capelin (Mallotus villosus) and sandlance (Ammodytes hexapterus). Unlike 1986, however, schooling fish were never observed in extensive concentrations and did not seem to be reliably found in a specific local for any length of time. This conclusion is based on qualitative hydroacoustic assessment, direct visual observations of schooling fish, and the associated behavior of the feeding whales. Further details of prey availability should be available from the results of the quantitative hydroacoustic assessment by personnel from the Auke Bay Laboratory.

As is most recent years (1981 to 1985), solitary, sub-surface feeding or browsing (e.g. near-shore feeding) was the predominant foraging strategy of humpback whales in Glacier Bay. No surface lunge-feeding on euphausiids was confirmed and there was little indication of any subsurface feeding on this prey species. There was, however, a single observation of bubble-net feeding on an unknown prey near the eastern shore of Young Island by animal #221 on July 23. This is one of the first confirmed observations of bubble netting in the bay since the 1970s when it was reportedly a common feeding strategy (Jurasz and Palmer 1981).

Icy Strait. Net tows and hydroacoustic assessment in 1983 and 1984 showed that adult herring, Clupea harengus, was the predominant prey at Point Adolphus (Krieger and Wing 1984; 1986). A similar assessment in 1987 indicated that this prey species continues to predominate at this location (K. Krieger, personal communication).

The foraging strategies of whales at Point Adolphus was dominated by a "core group" of six adults: Max, Scoper, Gertrude, #573, Frenchie, and Freckle Flukes (animals #539, 577, 587, 573, 166, and 155 respectively). With the exception of Max, these individuals have associated together repeatedly in previous years (Perry et al. 1985). These six adults were often joined by as many as three other individuals, most commonly #186, 193, and 193y, forming an impressively large pod that displayed a high degree of behavioral synchrony and coordinated movement. The repeated association of group members and their closely coordinated behavior suggests that these groups form for the purposes of cooperative foraging (Baker 1985). Other resident individuals at Point Adolphus were rarely if ever seen to join the core group and continued to forage alone (i.e. Garfuncle, #219, 530). The reasons for the voluntary or forced exclusion of these individuals are unknown.

Regional Movement

A preliminary analysis of photographs collected in other areas of southeastern Alaska documented the movement of four individuals from Glacier Bay - Icy Strait to Frederick Sound: Spot (#235), her calf, Max (#539), and #221. The regional movement of these whales was also accompanied by a change in their primary prey; switching from schooling fish in Glacier Bay - Icy Strait during June and July, to euphausiids in Frederick Sound during August and September.

Discussion

Population Characteristics

The 1987 summer season is the sixth season during which comparable information on whale abundance has been collected in the Glacier Bay - Icy strait area (Table 3). For Glacier Bay, these annual censuses show considerably variation with an apparent cycle of alternating high and low counts from 1982 to 1986. This apparent biennial cycle, however, did not persist through 1987 when the number of whales entering the bay remained high for a second consecutive year. In the combined Glacier Bay - Icy Strait areas, the number of whales has increased steadily during the last six years with the exception of 1983 when unusually low counts may have been, in part, the result of poor sampling conditions rather than a true decline in abundance.

Some of the increase in local whale abundance can be explained by the continued return of past residents and their offspring. This year, for example, at least four individuals that were first identified as calf in the Glacier Bay - Icy Strait area, returned

here as juveniles or yearlings. Since mortality is probably very low among adult humpback whales, the confirmed return of these juveniles indicates a net addition (though not an annual rate of increase) of about 8 - 10% to the local population over the last few years. Because many calves are not adequately identified, this is only a minimum estimate of recruitment to the local population. Some previously transient adults are also returning more regularly to the Glacier Bay area and are remaining for longer periods of time. Lumpy II (animal #262), for example, visited the bay for the first time in 1986 but returned this year to establish residency.

The confirmed return of three juveniles and the continued return of Garfuncle as an adult, are strong evidence of maternally-directed fidelity to a specific feeding local, such as Glacier Bay - Icy Strait, within a larger feeding region, such as southeastern Alaska,. The hypothesis that this site-fidelity can result in maternal kinship ties is supported by the observed associations of two siblings or half-siblings, the five-year old animal #186 and the three-year old #352. Both of these juveniles are the offspring of animal #530. Although #530 was not observed to interact directly with either of the juveniles, it is interesting to note that these three were among the few whales remaining near Point Adolphus in September of this year (Appendix I).

Although the return of several cow-yearling pairs has been reported on the feeding grounds of the northwestern Atlantic (Clapham and Mayo, in press); the continued association of animal #193 and her yearling at Point Adolphus this year is the first such case documented in southeastern Alaska. In general, calves are weaned and separate from their mothers on their return trip to the wintering grounds at about one year of age (Baker et al. in press). Although maintaining the maternal bond for an additional year may increase the calf/yearling's chances of survival, it could also prolong the interbirth interval of the cow. Future annual sightings of this pair are needed to evaluate the implications of this strategy for overall reproductive success.

LITERATURE CITED

Baker, C.S. 1983. Humpback whales in Glacier Bay; 1983 season. Final report to the National Park Service, Anchorage, Ak. 21 pp.

Baker, C.S. 1984. Population characteristics and feeding behavior of humpback whales in southeastern Alaska during 1984. Report to the National Marine Fisheries Service, Auke Bay, Ak. 44 pp.

Baker, C.S. 1985 (a). The humpback whales of Glacier Bay and adjacent waters: Summer 1985. Final report to the National Park Service, Gustavus, Ak. 25 pp.

Baker, C.S. 1985 (b). Population structure and social organization of humpback whales (Megaptera novaeangliae) in the central and eastern North Pacific. Doctoral Dissertation, University of Hawaii, Honolulu, HI.

Baker, C.S. 1986. Population characteristics of humpback whales in Glacier Bay and adjacent waters: Summer 1986. Final report to the National Park Service, Gustavus, Ak. 30 pp.

Baker, C.S., and L.M. Herman. 1984. Aggressive behavior between humpback whales, Megaptera novaeangliae, wintering in Hawaiian waters. Canadian Journal of Zoology 62:1922-1937.

Baker, C.S. and L.M. Herman. 1987. Behavioral responses of summering humpback whales to vessel traffic: Experimental and opportunistic observations. Draft report to the National Park Service, ALaska Regional Office, Anchorage, Ak. 90 pp.

Baker, C.S., L.M. Herman, B.G. Bays, and W.S. Stifel. 1982. The impact of vessel traffic on the behavior of humpback whales in Southeast Alaska: 1981 season. Report to the National Marine Mammal Laboratory, Seattle, Wa. 39 pp.

Baker, C.S., L.M. Herman, B.G. Bays, and G.B. Bauer. 1983. The impact of vessel traffic on the behavior of humpback whales in Southeast Alaska: 1982 season. Report to the National Marine Mammal Laboratory, Seattle, Wa. 31 pp.

Baker, C.S., L.M. Herman, and A. Perry. In press. The reproductive histories of female humpback whales (Megaptera novaeangliae) in the North Pacific. Marine Ecology - Progress Series.

Baker, C.S., L.M. Herman, A. Perry, W.S. Lawton, J.M. Straley, and J.H. Straley. 1985. Population characteristics and migration of humpback whales in southeastern Alaska. Marine Mammal Science 1(4).

Baker, C.S., L.M. Herman, A. Perry, W.S. Lawton, J.M. Straley, A.A. Wolman, H.E. Winn, J. Hall, G. Kaufman, J. Reinke, and J. Ostman. 1986. The migratory movement and population structure of humpback whales (Megaptera novaeangliae) in the central and eastern North Pacific. Marine Ecology - Progress Series 31:105-119.

Clapham, P.J. and C.A. Mayo. In press. Humpback whale mothers

and calves on Stellwagen Bank, Massachusetts: 1979-1985. Canadian Journal of Zoology.

Dean, F.C., C.M. Jurasz, V.P. Palmer, C.H. Curby and D.L. Thomas. 1985. Analysis of humpback whale (Megaptera novaeangliae) blow interval data: Glacier Bay,, Alaska, 1976-1979. Final report on Contract CX-9000-0-E099 to the National Park Service, Anchorage, AK.

Jurasz, C.M. and V.P. Palmer. 1981 (a). Censusing and establishing age composition of humpback whales (Megaptera novaeangliae) employing photodocumentation in Glacier Bay National Monument, Alaska. Report to the National Park Service, Anchorage, Ak. 44 pp.

Jurasz, C.M. and V.P. Palmer. 1981 (b). Distribution and characteristic responses of humpback whales (Megaptera novaeangliae) in Glacier Bay National Monument, Alaska. Report to the National Park Service, Anchorage, Ak. 85 pp.

Katona, S., B. Baxter, O. Brazier, S. Kraus, J. Perkins, and H. Whitehead. 1979. Identification of humpback whales by fluke photographs, pp. 33-44. In H.E. Winn and B.L. Olla (eds.) Behavior of marine animals, vol.3. Plenum Press, New York, NY.

Krieger, K. and B.L. Wing. 1984. Humpback whale prey studies in Southeast Alaska, summer 1983. Northwest and Alaska Fisheries Center, Auke Bay Laboratory, Auke Bay, Ak. 42 pp.

Krieger, K. and B.L. Wing. 1986. Hydroacoustic monitoring of prey to determine humpback whale movements. NOAA Technical Memorandum NMFS F/NWC-98. 62 pp.

Malme, C.I., P.R. Miles, P.T. McElroy. 1982. The acoustic environment of humpback whales in Glacier Bay and Frederick Sound/Stephens Passage, Alaska. Report to the National Marine Mammal Laboratory, Seattle, Wa. 120 pp.

Perry, A., C.S. Baker, and L.M. Herman 1985. The natural history of humpback whales (Megaptera novaeangliae) in Glacier Bay. Final report to the National Park Service, Alaska Regional Office, Anchorage, Ak. 41 pp.

Miles, P.R. and C.I. Malme. 1983. The acoustic environment and noise exposure of humpback whales in Glacier Bay, Alaska. Report to the National Marine Mammal Laboratory, Seattle, Wa. 74 pp.

Vequist, G.W. and C.S. Baker. 1987. Humpback whales of Glacier Bay: A long-term history of habitat usage. Draft report to the National Park Service, Gustavus, Ak. 16 pp.

Wing, B.L. and K. Krieger. 1983. Humpback whale prey studies in Southeast Alaska, summer 1982. Northwest and Alaska Fisheries Center, Auke Bay Laboratory, Auke Bay, Ak. 60 pp.

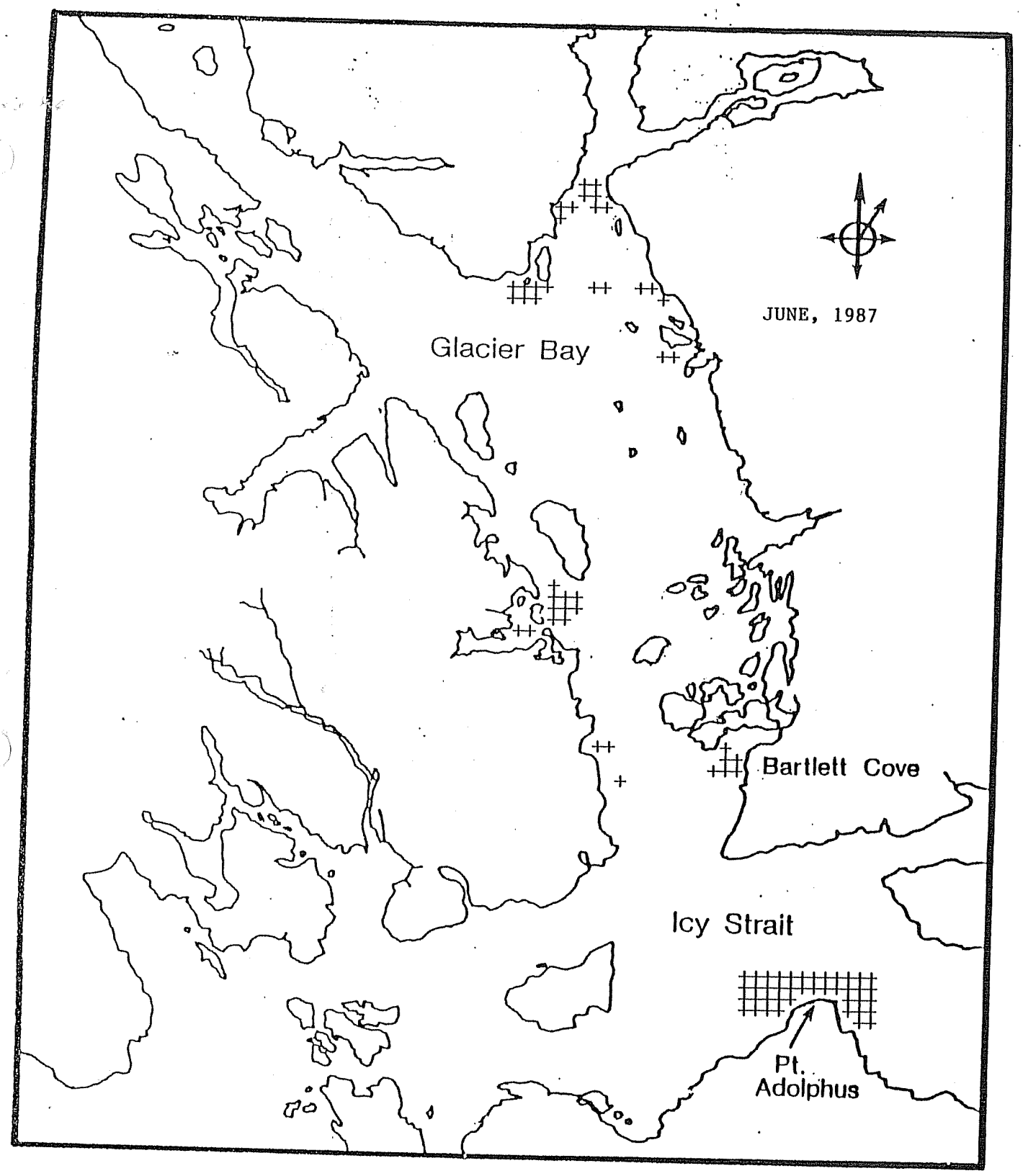
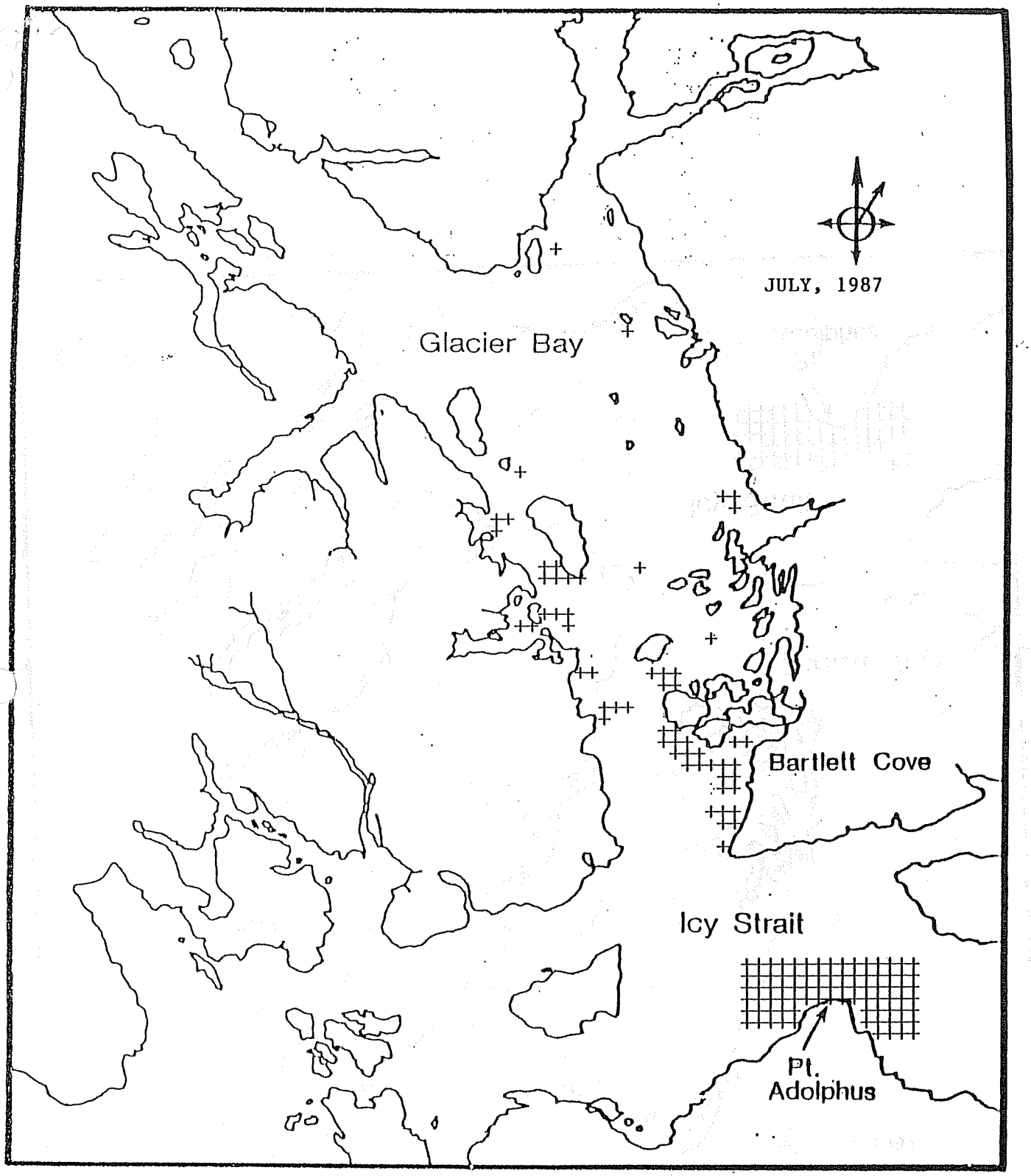
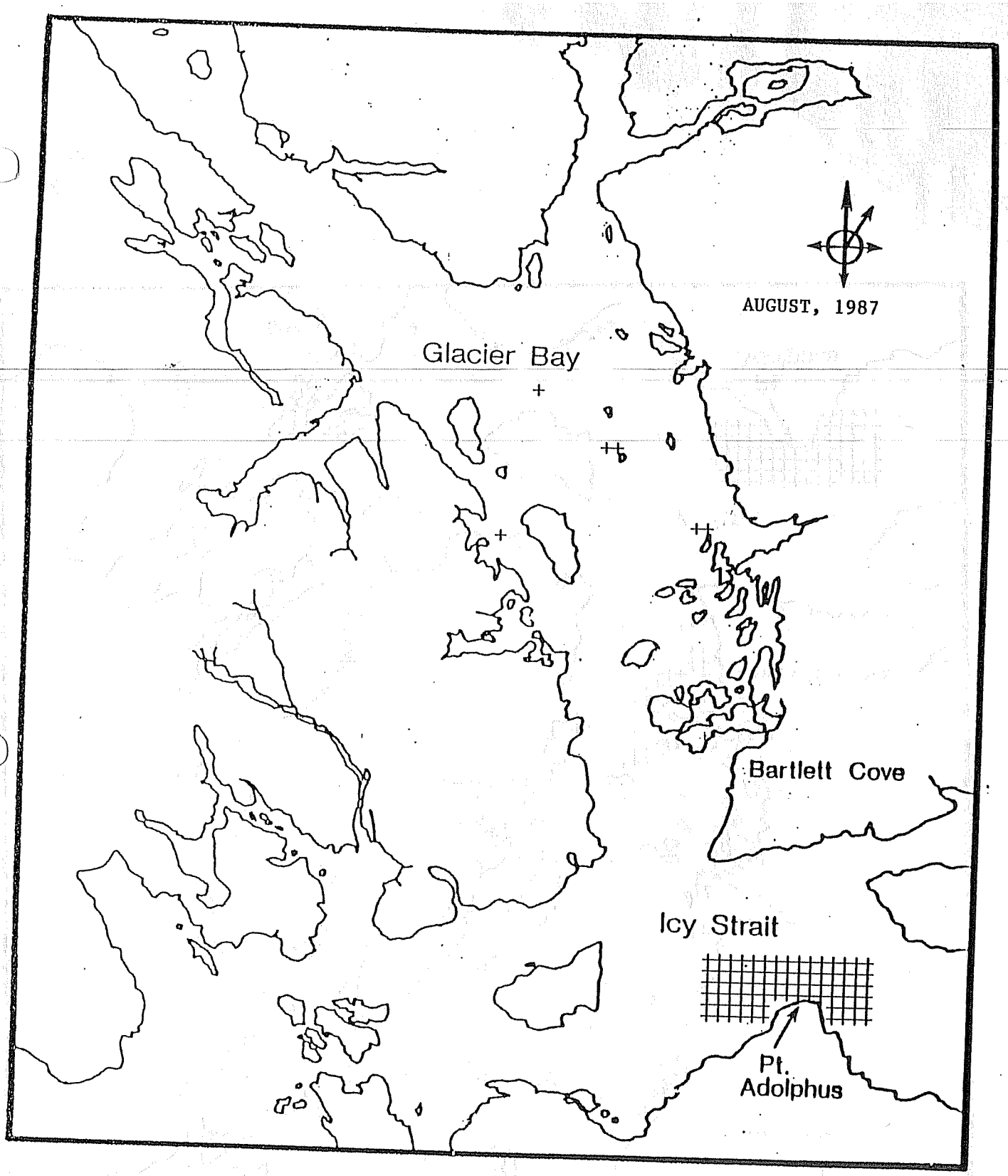

JUNE, 1987
Glacier Bay
Bartlett Cove
Icy Strait
Pt.
Adolphus

Figure 1:
The distribution of humpback whale sightings during the summer of 1987: a) June; b) July; c) August. Each + represents the daily sighting of an individual whale.


JULY, 1987
Glacier Bay
Bartlett Cove
Icy Strait
Pt.
Adolphus


AUGUST, 1987
Glacier Bay
Bartlett Cove
Icy Strait
Pt.
Adolphus

Appendix I: Sightings of humpback whales in Glacier Bay (G) and Icy Strait (I), Summer of 1987.

	Name	ID#	May 4	10	16	22	28	June 3	9	15	21	27	July 3	9	15	21	27	August 2	8	14	20	26	September 1	7	13	19	25
1.	Chop Suey	118	I					GG	G	G	G	G	G				I			GG		II					I
2.	MD	157	I				I		GI	IG			I		G	I	I		I	I	I		I				
3.	Garfuncle	516					I		I	I		I	IGI				I	I		I	I	I		II				
4.	Scoper	577					I	I	I	I			I	I	I	I	I	I	I	I	I	I						
5.	Gertrude	587					I		G	I			I	I	I	I	I	I	I		I	I	I	I				
6.	--	530					I			I					I	I	I						I			I	I
7.	--	351					I		G		G		G	I							I	I					
8.	--	584					I		GI				I			I											
9.	AIS01	--					I					G															
10.	--	352					I					GGG	G	G		I					I	II				I	
11.	White Eye	117						GG	G	G	GG	G			I												
12.	--	155						I	I	I	I	I	I	I	II	I	I		I								
13.	--	219						I	I	I	I		I	I			I	I	I	I							
14.	--	936						I																			
15.	AIS02	--						I		I																	
16.	RU TAYLOR	564							G	G	G	GG	G	G													
17.	--	573							I	I	I	I	I	I	II	I	I	I	I	I	I	I	IIII				
18.	--	875							I																		
19.	AIS13	--							I																		
20.	--	221								GG	G	GG	G		GG	GGG											
21.	AIS02.4	196								I																	
22.	AIS04	513								I																	
23.	AIS03 ♀	560								I																	
24.	--	566								G	G	G	G		I												
25.	AGB01	--									G											G					
26.	--	455									I																
27.	Max	539									I	I	I		II	I	I	I	I	I							
28.	AIS05	879									I																
29.	Dike	237									G		G	G	I				I								

(continued)

Appendix 1 (continued)